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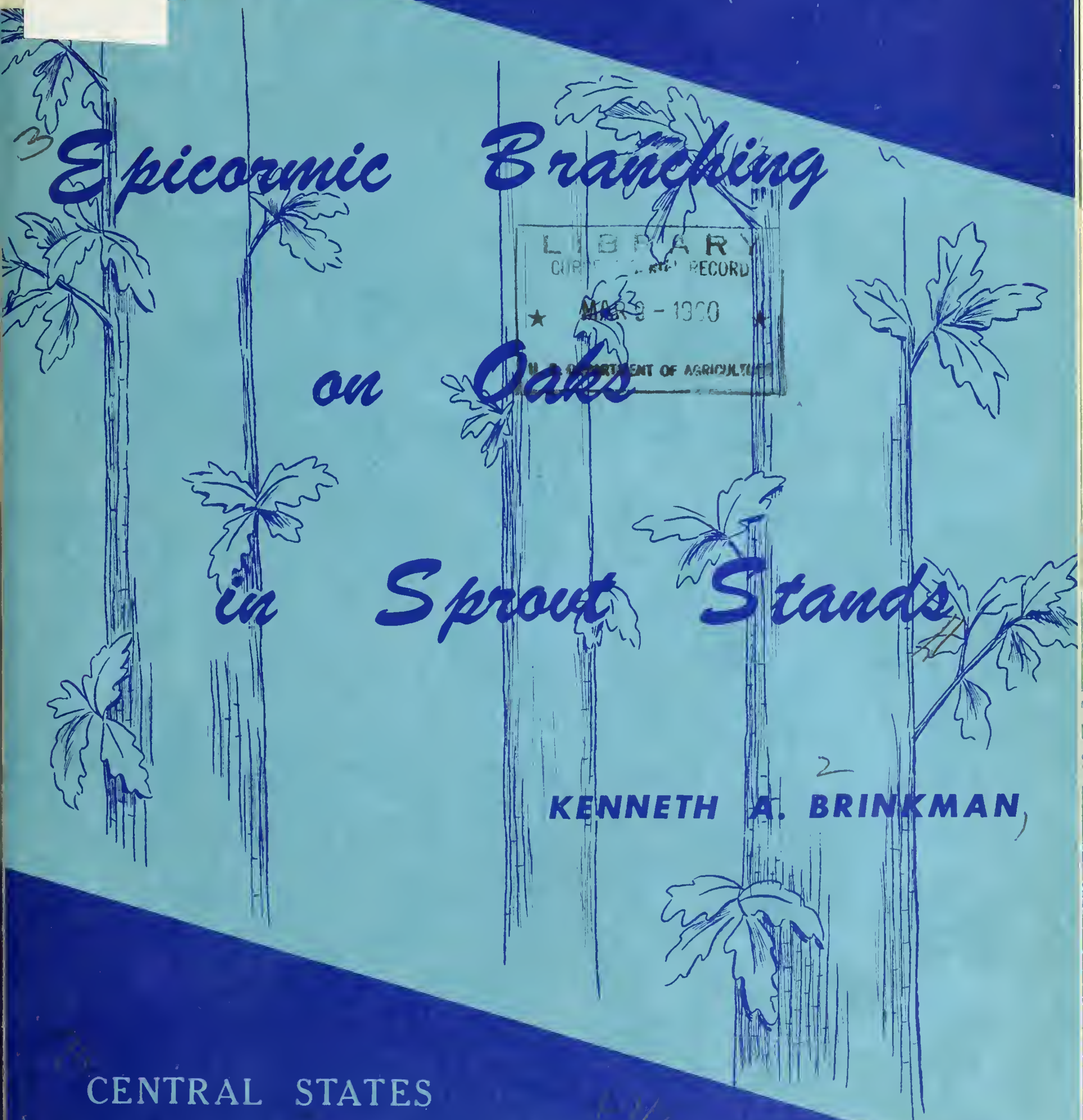

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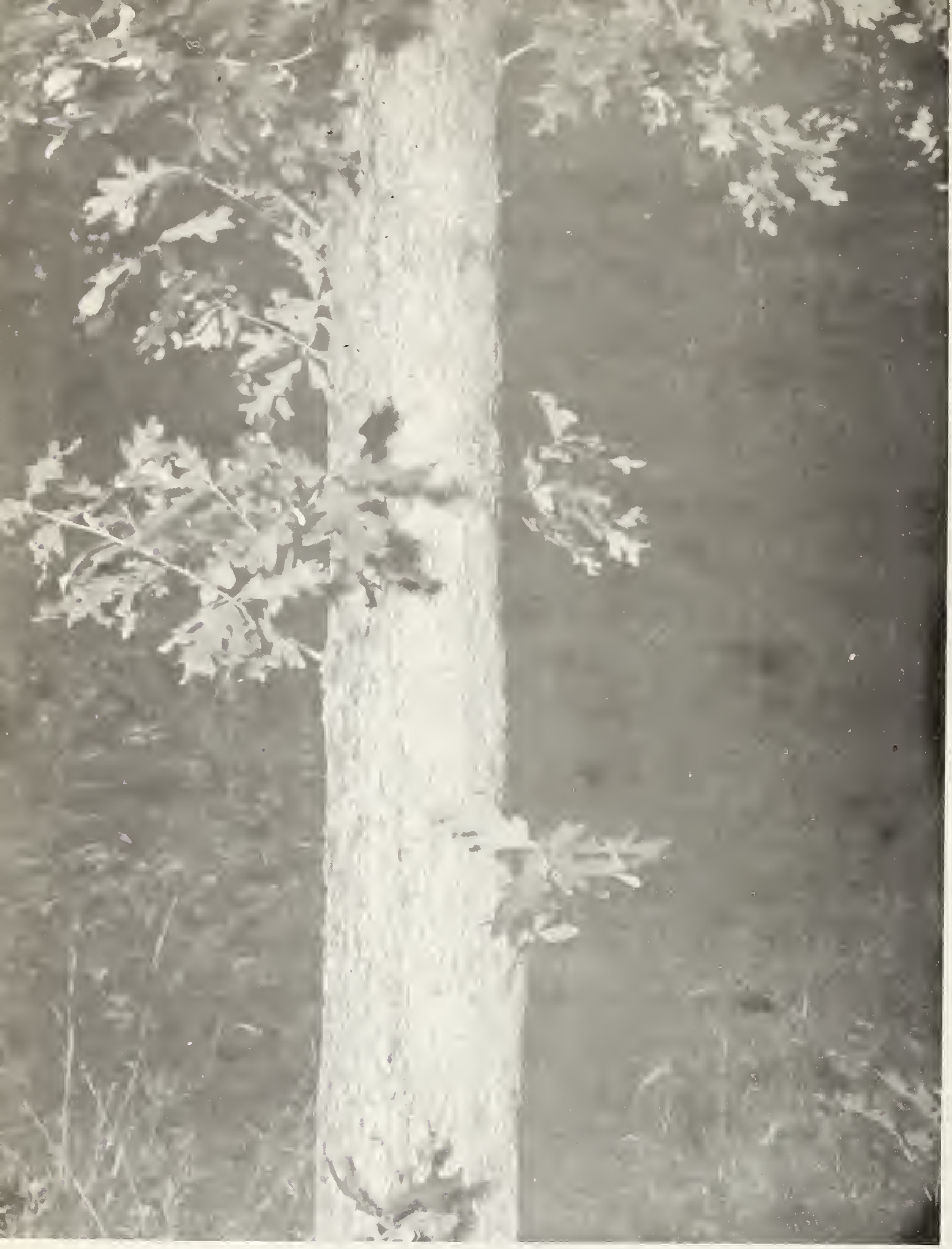

Epicormic branches on white oak.

EPICORMIC BRANCHING ON OAKS IN SPROUT STANDS

KENNETH A. BRINKMAN, Forester

The upland forest areas in many parts of northern Missouri, Iowa, and other parts of the upper Mississippi Valley now support stands of young oaks that originated almost entirely from stump sprouts. Such stands are even-aged and generally less than 60 years old. They are the first or second generation forests that followed clear cutting of the original stands.

Many trees in these sprout stands develop epicormic branches along the main boles, particularly after cuttings are made. The branches may arise either singly or in feathery clusters from dormant buds. These buds may persist for many years without forming recognizable surface defects on the tree. Once the buds sprout, however, blemishes are created which are definite defects in veneer and factory grade logs (2).[1] Even though the branches may die within a few years, scars or overgrowths result. These limit the value of the log because value depends largely upon the amount of clear wood the log will yield. Both the number and the position of defects are important.

To find out what conditions influence epicormic branching on upland oaks, more than 600 trees were examined in southeastern Iowa. Because of the small size of the trees, only the number of branches, or clusters of branches, in the butt log of each tree was considered. These were representative "crop" trees in a study where even-aged stands had been cut to leave basal areas ranging from 30 to 85 square feet per acre. Two age classes, 25 and 50 years, were represented. The stands were composed primarily of white oak (*Quercus alba* L.), with some black (*Q. velutina* Lam.) and northern red oak (*Q. rubra* L.) and hickory (*Carya* spp.).

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[1] Numbers in parentheses refer to Literature Cited, p. 8.

Stoeckeler and Arbogast (3) reported that heavy cuttings in northern hardwoods caused epicormic branching on the boles of both mature and 11-year-old trees. On the mature trees these branches persisted for years, often growing into fairly large limbs. By the end of 8 years, however, most of the sprouts had disappeared on the younger trees.

In old-growth Appalachian hardwoods, Jemison and Schumacher found that the original volume of a stand and the severity of cutting affected the number of epicormic branches produced on the remaining trees (1). Large original volumes and heavy cutting resulted in the most epicormic branches. Second-growth timber in general was believed to be more susceptible to epicormic branching than old growth.

Observations in oak sprout stands in Iowa and northeastern Missouri indicate that branching may be associated with but not necessarily restricted to trees that have been released by cutting. Even in heavily stocked young sprout stands, the lower stems of some trees resemble bottle brushes. The evidence also indicated that although the tendency toward epicormic branching might be inherited, the amount of branching is influenced by the degree of release in partial cuttings and the relative crown class of the individual trees. Overtopped trees nearly always develop feathers after being released. Branching is more common on trees growing in clumps than on single trees.

3 "Branching Classes" Used

The number of epicormic branches, or clusters of branches, in the first 16-foot log was used as a rough indication of the potential log quality. Trees were divided into three classes:

0-3 epicormic branches in first log
4-8 epicormic branches in first log
9+ epicormic branches in first log

Additional data recorded for each tree included:

1. Crown class
2. Average diameter growth since the plots were thinned
3. Average annual increase in length of twigs since the plots were thinned
4. Stem class
    - a. Single tree
    - b. One of a clump
        - (1) Clump essentially complete
        - (2) Clump partially cut
        - (3) Clump partially dead

The data show that stocking, crown class, and the number of trees sharing or originating from a common root system affect or are associated with epicormic branching on the main stem. Diameter-growth rate could not be correlated with branch development in most cases.

Stocking

Regardless of age or species, more epicormic branches or clumps of branches per crop tree occurred in the more open stands (fig. 1). Trees having 0-3 branches were rare. The greater number of 4-8-branch trees in the more densely stocked stands was statistically significant (at the 5 percent level). But the total number was low even in the younger stands.

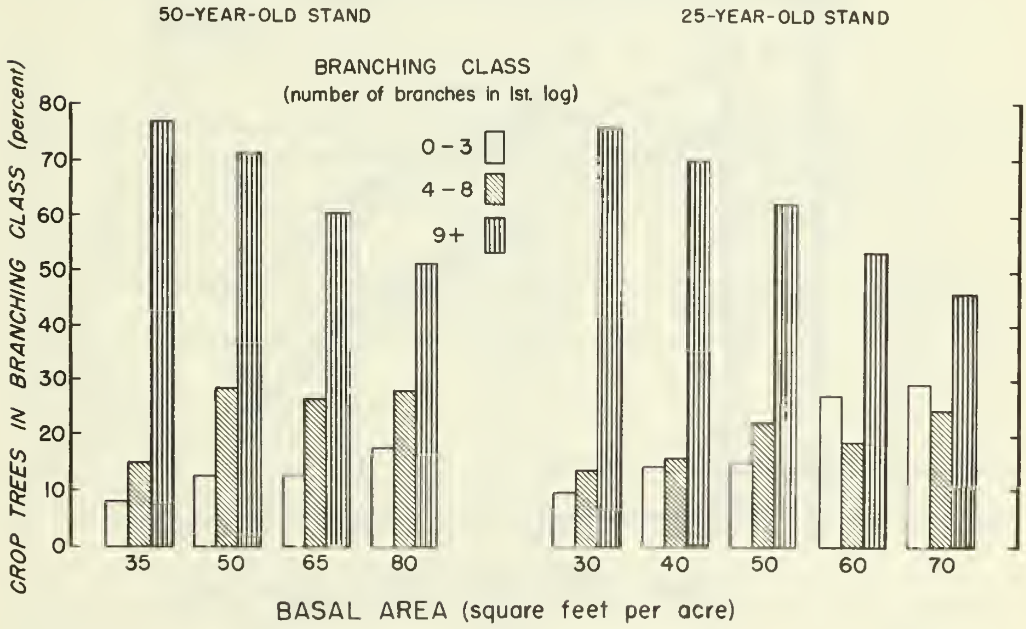

Figure 1.--Percentage of total trees in each branching class by basal area per acre. (All oak species combined.)

In stands stocked for good diameter growth, many crop trees had 9 or more branches in the first log. Some compromise in growth rate seems necessary to produce good quality trees.

In dense stands, the epicormic branches on the trees seldom grew very large. After the stands were opened up by partial cuttings, however, a very obvious increase occurred in the terminal growth rate of the existing branches (fig. 2).. In the plots having a residual stocking of 35-40 square feet of basal area per acre, the average increase in length per year for branches on white oaks was more than twice that in the uncut check plots. A similar relationship was found for the black oak group.

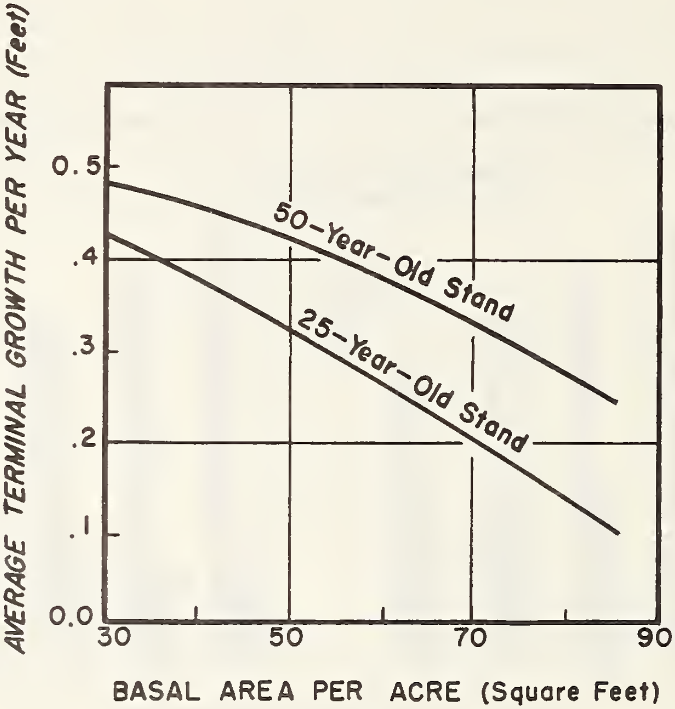

Figure 2.--Average annual increase in the length of branches of white oaks in the first log by stand age and basal area.

On trees that were given excess growing space, the increased size of existing branches, together with new epicormic branches, often resulted in larger, more effective crowns. As a result, in stands having the lowest residual stocking, the average diameter-growth rate for crop trees was significantly greater than in any other stocking. However, this rapid growth was at the expense of potential quality.

Crown Class

Dominant trees tend to have fewer epicormic branches (table 1). The number of 0-3-branch trees was significantly greater for dominant stems in the 25-year-old white oaks and in all the black oaks. But when the relative crown position of a tree was improved by the cutting operation, the tree generally developed many more branches than did other trees whose crown class was unchanged.

Table 1.--Relation between the crown class of crop trees and branching class for 25- and 50-year-old stands combined

Crown class		Branching class (Number of epicormic branches in first log)		
Original	Present	0-3	4-8	9+
		Percent	Percent	Percent
WHITE OAK				
Dominant	Dominant	21.2	27.0	51.8
Codominant	Dominant	5.3	14.7	80.0
Codominant	Codominant	14.8	18.5	66.7
Intermediate	Intermediate	2.5	20.0	77.5
All classes		13.4	19.6	67.0
BLACK OAKS				
Dominant	Dominant	49.2	25.4	25.4
Codominant	Dominant	11.1	29.6	59.3
Codominant	Codominant	22.8	26.3	50.9
Intermediate	Intermediate	12.5	12.5	75.0
All classes		30.4	25.8	43.8

Because of their more rapid early height growth, a greater percentage of black oaks than white oaks was in the upper crown classes. Considering all oak species in both age classes, many more black oaks had three or less living branches on the first log than white oaks. However, persistent dead branches on the black oaks usually would prevent trees of this species from producing high-quality logs, even if epicormic branches were absent.

Single Trees vs: Multiple-Stemmed Clumps

Stump sprouts usually persist as multiple-stemmed clumps for many years (4). More feathering occurs on these sprout clumps than on single trees. Moreover, if one or more such stems was removed from white oak clumps, either by cutting or as a result of natural mortality, branching on the remaining sprouts apparently increased (table 2). This difference was highly significant for white oaks, but less apparent for the black oak group in the 25-year-old stand. Similar comparisons were inconclusive for the 50-year-old stand, however, because it was difficult to determine whether these trees had originated singly or had been part of a clump at one time.

Table 2.--Relation between stem class and branching class for 25-year-old stand

WHITE OAK

Stem class	Branching class (Number of epicormic branches in first log)		
	0-3	4-8	9+
	Percent	Percent	Percent
Single trees	43.7	18.8	37.5
Clumps:			
Intact	22.5	25.4	52.1
Part cut	7.2	13.6	79.2
Part dead	16.8	14.7	68.5
Average	14.5	17.0	68.5
All classes	16.1	17.1	66.8

BLACK OAKS

Single trees	33.3	18.5	48.2
Clumps:			
Intact	37.6	18.8	43.6
Part cut	25.0	28.6	46.4
Part dead	30.4	30.4	39.2
Average	29.8	26.9	43.3
All classes	30.9	24.5	44.6

Diameter-Growth Rate Not Significant

The number of epicormic branches was not always clearly associated with diameter growth. For the older white oaks and for all black oaks, no measurable correlation existed. Only the young white oaks that grew 0.2 inches or more in diameter per year produced significantly more branches.

Summary

In Iowa, Missouri, and other parts of the upper Mississippi Valley, oak stands of stump-sprout origin have a strong tendency to produce epicormic branches or "feathers" on the main stem. In several such sprout stands that had been thinned 4 years earlier, the percentage of trees in the main canopy that were relatively free from epicormic branches was highest: (1) in stands having rather heavy stocking,(2) for dominant trees, and (3) for single stems as compared with multiple-stem clumps. It also was evident that relatively few high-quality trees would develop in oak stands that were of sprout origin without good management.

In such sprout stands, the greatest number of high-quality oaks can be grown in stands that are properly stocked and where single-stemmed, dominant individuals are favored throughout the rotation. Further studies are needed to determine optimum stocking and to find the best methods for managing oak stands, whether of sprout or seedling origin. It is possible that thinning from below might reduce epicormic branching. The tendency toward epicormic branching, particularly in sprout oak stands, is not limited to this region, but it may be more important here because other hardwood species of comparable value are lacking.

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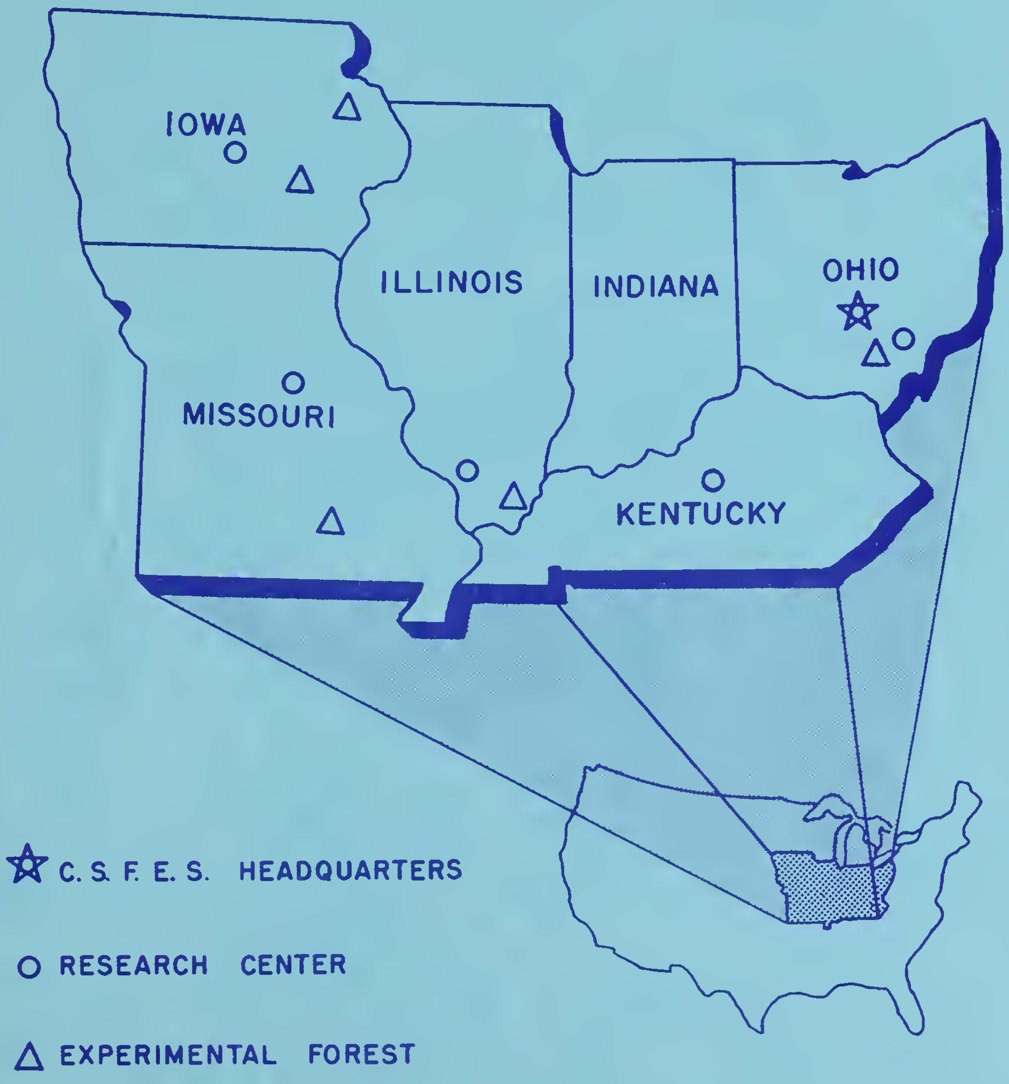

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